LASER SURFACE INTERACTIONS OF HIGH-T_c SUPERCONDUCTORS*

C. H. Chen, M. P. McCann, and R. C. Phillips, Chemical Physics Section, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6378.

During the past two years, one of the most exciting research fields in science has been the study of the newly discovered high-T_c metal oxide superconductors. Although many theoretical models were proposed, there has been no general agreement on any theory to explain these materials. One of the "peculiar" features of these high-T_c materials is the noninteger number of oxygen atoms. The oxygen content is extremely critical to the superconductive properties. Take $YBa_2Cu_3O_{7-x}$ as an example. Its superconductive properties disappear whenever x is larger than 0.5. The existence of Cu^{+3} has been considered to account for x less than 0.5. However, our results from mass spectroscopy of laser desorbed species indicate that significant quantities of oxygen molecules are trapped in the bulk of these high-T_c superconductors. It appears that these trapped oxygen molecules may play key roles in superconductive properties.

Preparation of superconductive thin films are considered very important for the applications of these new superconductors for the electronics industry. Fluorescence spectra and ion spectra following laser ablation of high-temperature superconductors were obtained. A real time monitor for preparation of superconductive thin films can possibly be developed.

*Research sponsored by the Office of Health and Environmental Research, U.S. Department of Energy under contract DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc.